

# **Noise Specification Sheets**

## **Ericsson RBS 2106 Outdoor Equipment Cabinets**

**EILAR ASSOCIATES**  
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May 7, 2003

PlanCom, Inc  
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Project #A30504

**SUBJECT: NOISE PLANNING FOR CINGULAR WIRELESS TELECOMMUNICATIONS FACILITY  
ERICSSON RBS 2102 / 2106 FOUR-CABINET OPEN SYSTEM INSTALLATIONS**

At your request, this letter provides noise planning information for a Cingular cellular system utilizing four outdoor BTS RBS 2102 / 2106 cabinets. This report presents the analysis based on an "open plan," where the facility is surrounded by a chainlink fence and is located at the minimum installation distances specified in the report from any property line or onsite building.

**Noise and Sound Level Descriptors**

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A-weighting, abbreviated "dBA," to approximate the hearing sensitivity of humans. Time-averaged noise levels are expressed by the symbol  $L_{EQ}$  for a specified duration. Short duration peak noise levels are expressed by the symbol  $L_{MAX}$ . The Community Noise Equivalent Level (CNEL) is a 24-hour average, where sound levels during evening hours of 7 p.m. to 10 p.m. have an added 5 dB weighting, and sound levels during nighttime hours of 10 p.m. to 7 a.m. have an added 10 dB weighting. This is similar to the Day-Night sound level,  $L_{DN}$ , which is a 24-hour average with 10 dB added weighting on the same nighttime hours but no added weighting on the evening hours. Sound levels expressed in CNEL are always based on A-weighted decibels. These data unit metrics are used to express noise levels for both measurement and municipal noise ordinances and regulations, for land use guidelines, and enforcement of noise ordinances. Some of the data may also be presented as octave-band-filtered and/or -octave-band-filtered data, which are a series of sound spectra centered about each stated frequency, with half of the bandwidth above and half below each stated frequency. This data is typically used for machinery noise analysis and barrier effectiveness calculations. (Further explanation can be provided upon request.)

Noise emission data is often supplied per the industry standard format of Sound Power, which is the total acoustic power radiated from a given sound source as related to a reference power level. Sound Power should not be confused with Sound Pressure, which is the fluctuations in air pressure caused by the presence of sound waves, and is generally the format that describes noise levels as heard by the receiver.

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## Applicable Noise Standards

The applicable regulations for these projects are contained within the relevant community or County of San Diego municipal code (noise ordinances). These ordinances typically provide that the hourly average noise limit for any noise source impinging on a single-family residential zone is not to exceed 45 dBA between the hours of 10 p.m. to 7 a.m. (nighttime hours). However, some municipalities, including the City of San Diego, have a more restrictive nighttime noise limit of 40 dBA. Daytime noise limits are normally less restrictive, allowing 5 dBA higher noise levels during the hours of 7 a.m. to 10 p.m. Noise limits are also less restrictive in commercial and industrial land use zones.

## Potential Project-Related Noise Source(s)

These installations propose to install four RBS 2102 / 2106 telecommunications cabinets (these are functionally similar units and nearly identical for noise emission and noise planning purposes), within planned equipment enclosures. The predominant noise sources from each equipment cabinet are the intake and exhaust louvers, located on the front side of each equipment cabinet. The equipment cabinets are expected to operate 24 hours per day, 7 days per week, 365 days per year.

## Similar Equipment Noise Emission Measurements

To accurately assess the expected equipment noise levels from the proposed installation, noise levels of similar operational equipment cabinets were measured at 10:30 a.m. on October 17, 2002, at a Cingular wireless installation located at the "Strouds" store in Mission Valley, San Diego. The equipment cabinets were installed inside an enclosed second-floor room. Access to the equipment enclosure was via a ladder and hatch from an outside entrance.

The 20-foot by 14-foot equipment room containing the operational cabinets had a 10-foot high ceiling. The room was highly reverberant, due to the plywood floor, three sheet-rocked walls and ceiling, and the fourth wall which appeared to have originally been a sprayed stucco exterior wall. Installed in the room were three RBS 2102 cabinets, all in operation. The equipment was situated in an "L" shape around two walls, with the ventilation louvers (noise sources) facing toward the center of the room. Outside noise sources were negligible.

The similar equipment noise emission levels were measured with a Larson Davis Model 824, Type 1 Sound Level Meter, Serial #342 (with windscreen), and Larson Davis Model CA200, Type 1 Calibrator, Serial #2181. The sound level meter was field-calibrated immediately prior to the noise measurements and checked afterwards, to ensure accuracy. All sound level measurements conducted and presented in this report, in accordance with the regulations, were made with a sound level meter that conforms to the American National Standards Institute specifications for sound level meters (ANSI S1.4-1971). All instruments are maintained with National Bureau of Standards traceable calibration, per the manufacturers' standards.

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The Larson Davis 824 sound level meter was mounted on a tripod in the approximate center of the room at a distance of approximately six feet from the two end (of the "L") cabinets and eight feet from the corner cabinet. The measured overall noise level for a one-minute measurement was 56.8 dBA. The octave data is summarized in Table 1; the full-octave data table is provided as Attachment 1. The Ericsson RBS 2106 data sheet is provided as Attachment 2.

Table 1. Noise Measurement of Three Operational Cingular RBS 2102 / 2106 Cabinets (at 6 feet)									
Octave Frequency Band (Hz)	63	125	250	500	1K	2K	4K	8K	Total Leq
Noise Level (dB)	63.3	61.4	60.9	55.7	48.6	40.8	36.6	34.6	56.8 dBA

Due to the reverberant room effect on the noise measurements, the measured noise levels of the operational equipment provide a maximum worst-case noise emission level for the equipment cabinets. Thus, when these measurement data are utilized "as is," the resultant analysis will be conservative.

#### Project-Related Equipment Noise Level

The measured noise data for the three-cabinet installation has been multiplied by 4/3, to provide analysis for the future proposed Cingular four-cabinet installations.

The calculated noise level of the proposed four-cabinet installations is 58.1 dBA LEQ, as shown in Table 2.

Table 2. Calculated Noise Level of Four Cingular RBS 2102 / 2106 Cabinets (at 6 feet)									
Octave Frequency Band (Hz)	63	125	250	500	1K	2K	4K	8K	Total Leq
Noise Level (dB)	64.6	62.6	62.1	56.9	49.9	42.0	37.9	35.8	58.1 dBA

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### Distance Attenuation

Attenuation due to distance is calculated by the equation  $SPL_1 = SPL_2 - 20 * \log (D_2/D_1)$  where:

$SPL_1$  = Calculated sound pressure level at distance

$SPL_2$  = Known sound pressure level at known distance

$D_1$  = Distance from source to known sound pressure level

$D_2$  = Distance from source to location of calculated sound pressure level

This is identical to the more commonly used reference of 6 dB reduction for every doubling of distance. This equation does not take into account reduction in noise due to atmospheric absorption.

Tables 3 and 4 present calculated distances for the target nighttime noise levels (40 and 45 dBA), for soft-surface and hard-surface environments.

In a hard-surface environment (pavement or concrete surrounding surfaces), the noise level at any given location will be a maximum of 3 dBA higher than in a soft-surface environment, due to the reflectivity of the ground between the source and receiver. The noise level calculations in Table 3 account for this difference.

Table 3. Required Distances for Noise Level Goals in Soft-Surface Environment <sup>1</sup>		
Calculated Four-Cabinet Noise Level	Nighttime Property Line Noise Level Goal	Required Distance <sup>2</sup>
58.1 dBA $L_{EQ}$ at six feet	45 dBA $L_{EQ}$	27.1 feet
	40 dBA $L_{EQ}$	48.2 feet

Table 4. Required Distances for Noise Level Goals in Hard-Surface Environment <sup>1</sup>		
Calculated Four-Cabinet Noise Level	Nighttime Property Line Noise Level Goal	Required Distance <sup>2</sup>
58.1 dBA $L_{EQ}$ at six feet	45 dBA $L_{EQ}$	38.3 feet
	40 dBA $L_{EQ}$	68.1 feet

<sup>1</sup> without sound attenuation wall

<sup>2</sup> minimum distance from closest cabinet to impacted receiver

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### **Required Distances for 45 dBA Nighttime Property Line Noise Limit**

When the area around the proposed facility consists of soft surfaces, such as loose dirt or grass, the equipment must be placed at a distance greater than 27.1 feet from the nearest impacted location, to provide a noise level below 45 dBA  $L_{EQ}$ .

If the proposed facility is surrounded by hard surfaces, such as hard packed dirt, pavement, or concrete, the equipment must be placed at a distance greater than 38.3 feet from the nearest impacted location to provide a noise level below 45 dBA  $L_{EQ}$ .

### **Required Distances for 40 dBA Nighttime Property Line Noise Limit**

When the area around the proposed facility consists of soft surfaces, such as loose dirt or grass, the equipment must be placed at a distance greater than 48.2 feet from the nearest impacted location to provide a noise level below 40 dBA.

If the proposed facility is surrounded by hard surfaces, such as hard packed dirt, pavement or concrete, the equipment must be placed at a distance greater than 68.1 feet from the nearest impacted location to provide a noise level below 40 dBA.

### **On-Site Residences or Buildings**

The above described distance limitations must also pertain to on-site residences and other buildings, both to provide quality of life for residents and to prevent noise reflections (which would increase the required distances for property line noise limit compliance).

### **Limitations**

This analysis is based on the noise emission for the fan side (front) of each cabinet, to present a worst-case analysis, since the fans are the loudest noise source. Accordingly, it is safe to assume that the orientation of a planned installation will not cause the projected noise level to be higher than calculated in this analysis.

Since the measured noise levels of the other three sides of the cabinets will be lower, the minimum required distances from the remaining three sides may be somewhat less than indicated above. However, a separate analysis of the specific installation would be required to determine these distances, which may be useful in proposed locations with space limitations.

The analysis and results presented in this report are based on the best data available for the Ericsson RBS 2102 / 2106 cabinets only; the results are not valid for other types of units or in conjunction with air conditioning equipment. There may be minor variations in noise emission from similar units.

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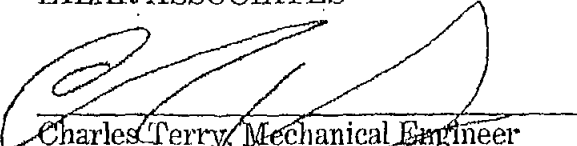
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Other enclosure systems, besides the open chain link fence design (i.e., wooden fences or CMU walls), may be utilized with the same distances specified in this report. However, under no circumstances are other enclosure systems to be presumed to allow any reduction in the specified distances between the equipment and the property line or other sensitive receivers, without a site-specific acoustic analysis of the particular enclosure.

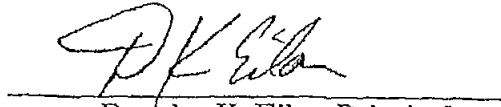
### Certification

The findings and recommendations of this acoustical analysis are based on the information available and represent a true and factual analysis of the potential acoustical issues associated with proposed Cingular Wireless unmanned telecommunications facilities designed with Ericsson RBS 2102/2106 four-cabinet equipment systems. This report was prepared by Charles Terry and Douglas Eilar.

### EILAR ASSOCIATES



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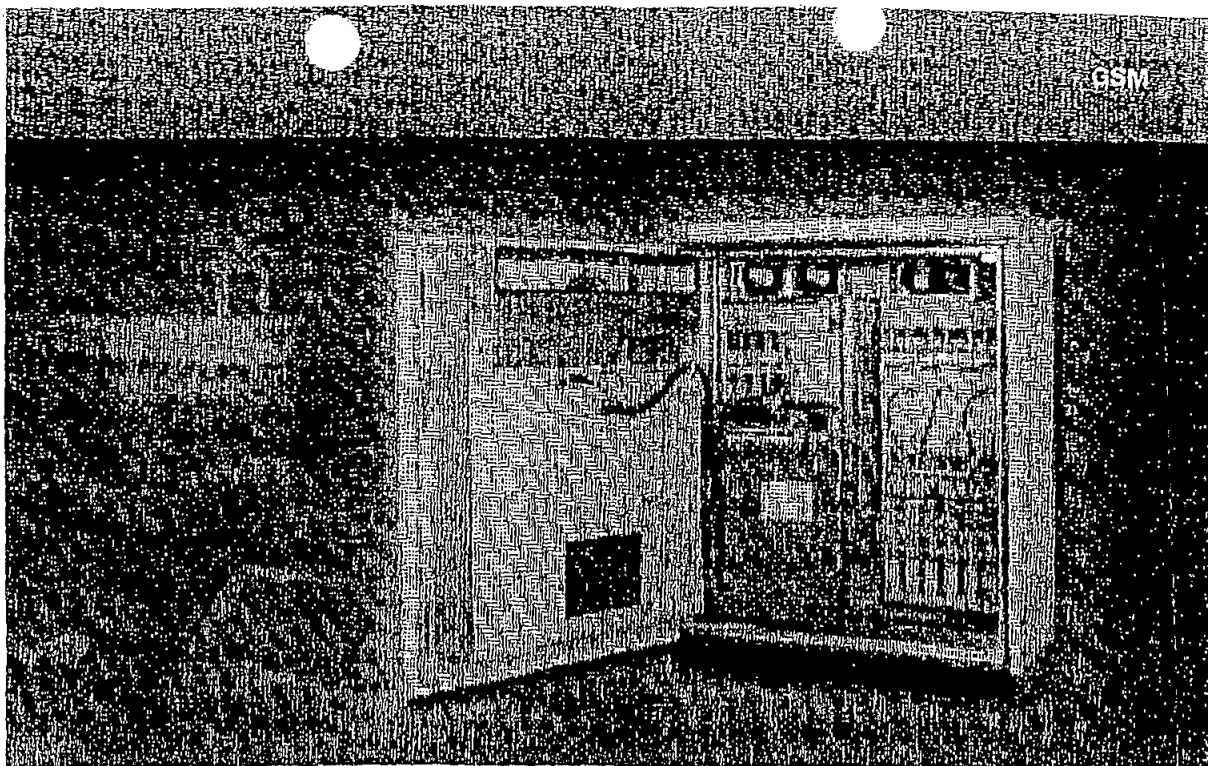
### Attachments

1. One-Third Octave Data with 1-Octave Conversion Table of Operational Cingular Three-Cabinet
2. Ericsson RBS 2106 Data Sheet

### References

Beranek, Leo L., *Acoustical Measurements*, Published for the Acoustical Society of America by the American Institute of Physics, Revised Edition, 1988.

Harris, Cyril M., *Handbook of Acoustical Measurements and Noise Control*, Acoustical Society of America, 3<sup>rd</sup> Edition, 1998.

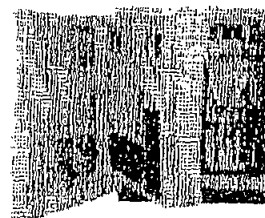


## RBS 2106

*RBS 2106 is a high capacity, outdoor macro base station supporting up to twelve transceivers per cabinet. It is possible to build one, two and three sector configurations including dual band GSM 900/GSM 1800, in one cabinet. The RBS 2106 supports Enhanced Data rates for Global Evolution (EDGE) and Wideband Code Division Multiple Access (WCDMA) through plug-in units.*

The RBS 2106 is a member of the highly successful radio base station family RBS 2000. The RBS 2000 family supports a wide range of applications ranging from extreme coverage to extreme capacity.

Being a RBS 2000 member guarantees coexistence with the installed base of RBS 200 and RBS 2000 products. Ericsson's synchronization based BSS features ensure that transceivers from different generations of radio base stations can easily form common cells. Operators can therefore bridge the past with the future. By making existing sites futureproof, investments are protected while migrating to 3G.



### Part of the grow-on-site concept

Since it is becoming increasingly difficult to find new base station sites, it is of great interest to remain on existing sites as long as possible. Site space is often a limiting factor for capacity growth. The powerful RBS 2106, included in Ericsson's grow-on-site toolbox, addresses this problem.

On many sites, two or more existing cabinets can be replaced by one RBS 2106, thereby solving the site space problem by making room for another cabinet. This is of major importance, since it makes it possible to reuse and collocate GSM and WCDMA equipment. Furthermore, the plug-in WCDMA transceiver unit (W-TRU) can later be directly housed in the RBS 2106.

### Doubled capacity

#### - superior performance - same footprint

The 12-transceiver RBS 2106 cabinet has the same footprint as RBS 2102 but has doubled capacity, thanks to new double-capacity transceivers and combiners.

The double transceiver unit (dTRU) has some powerful features. The RBS 2106 has better output power than current RBS 2000 products, which are the best on the market today. The improved radio performances mean increased site-to-site distance, and therefore, fewer sites. Another example of a cost saving feature is 121 km Extended Range.

The RBS 2106 comes with two new, extremely flexible combiners. Examples of configurations for 900 and 1800 MHz, supported by the filter combiner (CDU-F), are 3x4, 2x6, 1x12 and dual band 8+4 or 4+8 in one cabinet. CDU-F supports up to 12 transceivers. The other combiner (CDU-G) for 900, 1800 and 1900 MHz can be configured in two modes: capacity mode and coverage mode, making it very flexible. In coverage mode, the output power from the CDU-G is increased, making it perfect for rural sites or when fast rollout is required at a minimum cost. To build a 3x4 configuration, one RBS 2106 cabinet is equipped with three CDU-Gs.

### Prepared for the future

The RBS 2000 family is prepared for GSM data services, including General Packet Radio Service (GPRS), High Speed Circuit Switched Data (HSCSD) and 14.4 kbit/s timeslots.

To meet the operators' need for faster datacom solutions, RBS 2106 supports EDGE. A powerful Distribution Switch Unit (DXU) and fast internal buses guarantee full EDGE support. This new DXU is also prepared for IP based Abis transmission.

With the optional BSS feature RBS 2000 synchronization, it is possible to have up to 32 transceivers in one cell. With the optional BSS feature RBS 200 and RBS 2000 in the same cell, it is possible to expand an existing RBS 200 cell with RBS 2106, and thereby introduce EDGE and WCDMA through plug-in units.

### Key features

- Six double transceiver units (dTRU), that is, 12 transceivers
- Filter and hybrid combining one, two, or three sectors in one cabinet
- Improved radio performance
- Synthesized and baseband frequency hopping
- Supports 12 transceiver EDGE on all timeslots
- Supports 900, 1800 MHz and 1900 MHz
- Extended Range 121 km
- Duplexer and TMA support for all configurations
- Four transmission ports supporting up to 8 Mbit/s
- Optional built-in transmission equipment
- Prepared for IP based Abis transmission
- Prepared for GPS assisted positioning services
- Internal and external battery back-up

### Technical specifications for RBS 2106

Frequency band:	E-GSM 900, GSM 1800, GSM 1900
Tx:	925-960, 1805-1880, 1930-1990 MHz
Rx:	880-915, 1710-1785, 1850-1910 MHz
Number of transceivers:	2-12
Number of sectors:	1-3
Transmission interface:	1.5 Mbit/s (T1), 2 Mbit/s (E1)
Footprint (H x W x D):	1614 x 1300 x 710 mm including installation frame (83 1/2 x 51 1/5 x 28 in.)
Dimension (H x W x D):	1614 x 1300 x 940 mm (63 1/2 x 51 1/5 x 37 in.)
Weight without batteries:	550 kg (1211 lbs.)
Power into antenna feeder:	33 W / 45.2 dBm (GSM 900)
	25 W / 44.0 dBm (GSM 1800 / 1900)
Receiver sensitivity:	-110 dBm (without TMA)
Power supply:	200-250V AC, 50 / 60 Hz
Integrated battery back-up:	Typical 1 hour (fully equipped)
External battery back-up:	Optional 2 hours
Operating temperature:	-33°C - +45°C (-27°F - +113°F)
Weatherproofing:	Min level IP55 in IEC 529